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18 Relational Learning in Children with Autism through Stimulus Pairing Training

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I. Introduction

In early language instruction and cognitive skills training for children with developmental disabilities, the formation of relationships among stimuli or events is often established through matching-to-sample (MTS) tasks. In an MTS task, a person is made to choose one stimulus corresponding to another stimulus (sample stimulus) from among multiple stimuli (comparison stimuli). For example, a child is trained to choose B in the presence of A and to choose C in the presence of B. As a result, the child is able to understand the conditional relationship between these stimuli (i.e., if A, then B and if B, then C). Later on, many studies demonstrated that these MTS training sessions facilitated not only trained conditional relations but also untrained conditional relations: symmetrical relations (i.e., if B, then A and if C, then B), transitive relations (i.e., if A, then C), and equivalence relations (i.e., if C, then A). These phenomena are termed as stimulus equivalence (Sidman and Tailby, 1982). A stimulus equivalence paradigm has often been used to teach children with developmental disabilities a variety of language or cognitive skills (e.g. Noro, 2005). On the other hand, many studies reveal that people with de-

velopmental disabilities or young children with typical development find it difficult to learn conditional relations in standard MTS tasks (e.g. Saunders and Spradlin, 1989; Pilgrim et al., 2000). Thus, in an applied setting, it becomes necessary to reveal the variables that encourage the learning of conditional relations in MTS tasks or to develop procedures other than MTS tasks to enable individuals to learn the relations among stimuli.

As one of the procedures other than MTS tasks, some studies suggest that conditional relations or equivalence relations are trained by the spatial and temporal proximity between stimuli (e.g. Leader et al., 1996; Smeets et al., 1997; Tonneau and Gonzalez, 2004). For example, Smeets et al. (1997) taught equivalence relations to 5-year-old children with respondent-type training. In this, the children were simply required to observe stimuli that are successively paired wherein several of them could learn the paired stimulus relations as well as other untrained relations. Despite the positive effects, very few studies have examined the possibility for children with developmental disabilities.

In this study, we examined the effectiveness of stimulus pairing training procedures for a boy with autism in order to teach him kanji-dictated reading-picture equivalence relations.

II. Method

1. Participant

The participant was a 10-year-old boy suffering from autism. His developmental age was 69 months. He was able to read all the hiragana and katakana characters and could also fluently read short sentences of hiragana or katakana words. However, he could read only a few kanji characters imparted in the first grade at Japanese elementary schools.

2. Stimuli

Fifteen kanji characters, which were selected from Kyoiku Kanji (Japanese Ministry of Education, Culture, Sports, Science, and Technology; 1998), 12 dictated readings of each kanji character or dictated names of pictures (auditory stimulus), and 12 picture stimuli corresponding to the meaning of each kanji character or dictated name were used in this study. Table 1 shows 12 stimulus classes, which were learned in this study. Only 3 kanji characters were used in the pretraining. These stimulus classes were divided into 4 stimulus class sets each comprising 3 stimulus classes (see Table 1).

Table 1. Stimulus Class Sets

	Kanji	reading	Picture
Set 1	足	ashi	
	犬	inu	
	虫	mushi	
Set 2	赤	aka	
	青	ao	
	白	shiro	
Set 3	牛	ushi	
	象	zou	
	鳥	tori	
Set 4	馬	uma	
	魚	sakana	
	羊	hitsuji	
Pretraining	花	–	–
	手	–	–
	車	–	–

3. Procedure

In this study, all tasks were presented on a 12.1 monitor of laptop computer. The participant performed the tasks using a wireless laser mouse. All the tasks were controlled by a program, created using visual basic.NET. This study used a non-concurrent multiple baseline design across the stimulus class sets.

3.1. Pretraining phase

Two 3-choice identity MTS tasks were conducted. The first was identity MTS training, wherein the child was made to choose one kanji character out of three comparisons, which were identical to the sample stimulus. A correct choice was reinforced by a large red double circle and short fanfare. A retrial was given to any incorrect choice until the child chose the correct one. All the choice responses were drag-and-drop responses. All 9 trials were conducted in the first training block. Intertrial-intervals (ITI) were 1 second with a blank screen. After the last trial was terminated, the participant's favorite picture was presented on the monitor for 7 seconds, regardless of his performance. The second task was the identity MTS

test, which was identical to the first identity MTS training except that any feedback or consequences were given to his correct or incorrect choice response.

3.2. Pretest phase

Here, 3-choice arbitrary MTS tests were conducted. These arbitrary MTS tests were identical to the identity MTS test in the pretraining phase except that here, 3 kinds of arbitrary MTS skills were assessed. The 3 kinds of arbitrary MTS skills consisted of dictated name-picture MTS, dictated reading-kanji MTS, and picture-kanji MTS tasks (the upper portion of Figure 1 shows picture-kanji MTS trials as an instance). One test block consisted of 9 trials (i.e., each arbitrary MTS test has 3 trials in one test block).

3.3. Stimulus pairing training and MTS test phase

In stimulus pairing training, one of the kanji characters in a trained stimulus class set was presented on the monitor. Immediately after the participant clicked on the kanji character, corresponding dictated reading was presented. The next kanji character in the trained stimulus class set was presented after 1 second (see the lower portion of Figure 1). These stimulus pairings were conducted in a total of 12 trials in one block, that is, each kanji was paired with its corresponding dictated reading four times in one block in a random order. Immediately after one block of stimulus pairing was complete, 6 trials of the MTS test were conducted. These MTS tests consisted of 3 dictated reading-kanji MTS test trials and 3 dictated name-picture MTS tests. The former test was the test of symmetrical relation with pairing training. The cycle of this stimulus pairing training block and MTS test block was continued until the following criteria were met. If the participant was able to complete all the MTS tests for 3 successive blocks (2 blocks in stimulus class set 4), he finished the training and test cycle and progressed to the next posttest phase. If the participant was unable to complete the MTS tests for 4 successive blocks, the training was interrupted. In another condition, the training and test cycle was continued.

3.4. Posttest phase

The MTS test block, which was identical to the pretest phase, was conducted. Picture-kanji MTS tests were considered as the equivalence relation test with pairing training. The MTS test block was conducted 1 or 2 weeks later. Another test block was also conducted in stimulus class sets 3 and 4, which consisted of dictated name-picture MTS, kanji-picture MTS, and kanji-reading tests.

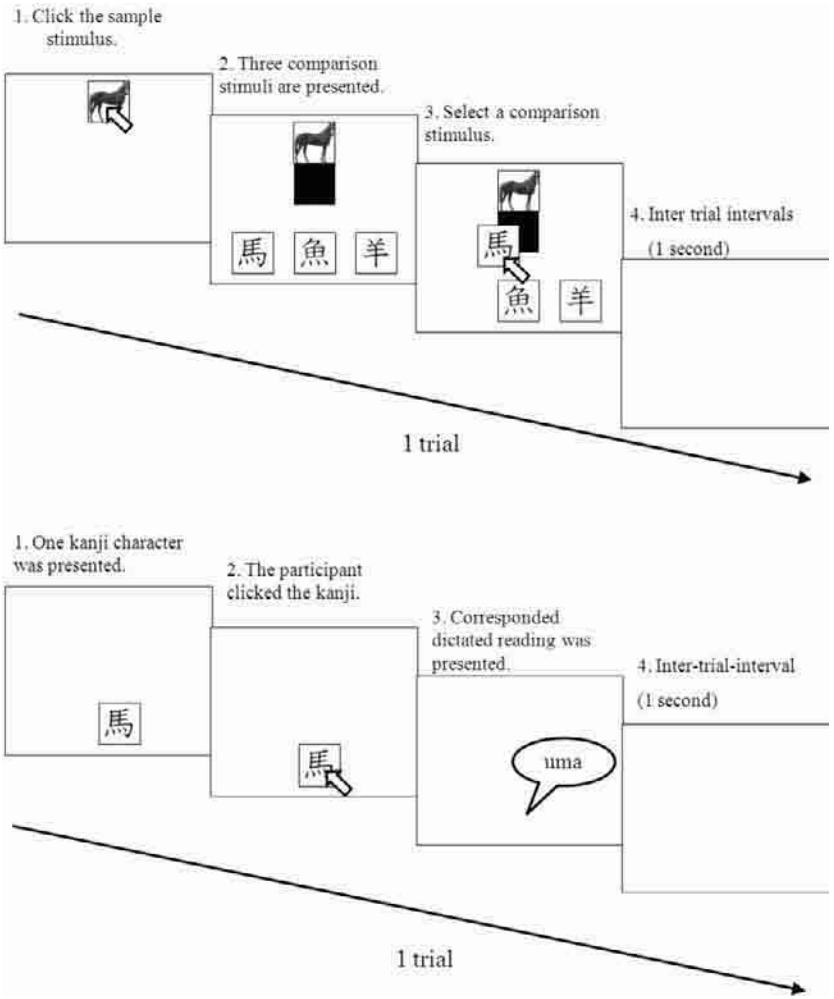

Figure 1. Training and Test procedures

III. Results

Figure 2 shows the number of correct responses in each block of MTS test during the pretest phase, stimulus pairing training and MTS test phase, and posttest phase. Maximum correct responses were obtained in 9 trials in the pretest and posttest phases and in 6 trials in the stimulus pairing training and MTS test phases. In the pretest phase, the participant could match pictures to dictated names but was unable to perform well in the other MTS tests (i.e., dictated reading-kanji and picture-kanji

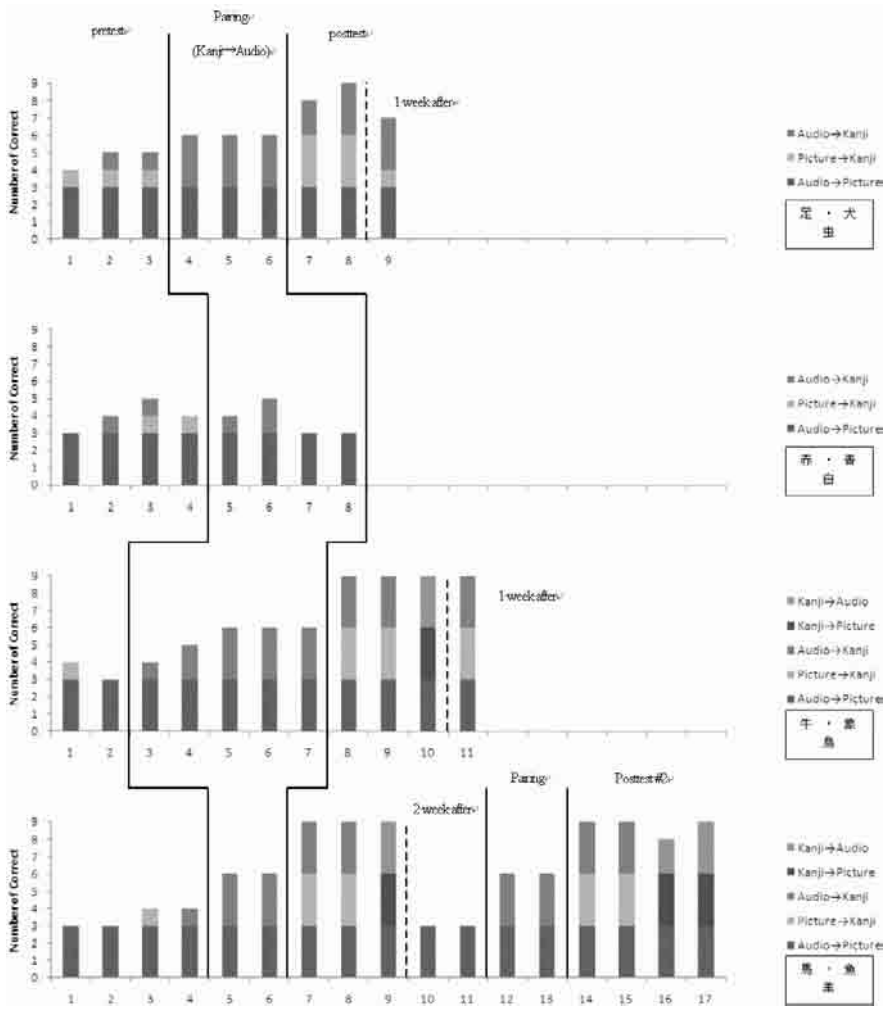

Figure 2. Number of correct responses in MTS test

MTS) in all the four stimulus class sets. In the stimulus pairing training and MTS test phase, the number of correct responses in the symmetry test increased and became steady in stimulus class sets 1, 3, and 4. In stimulus class set 2, however, there was no increase for 4 successive blocks after which training was terminated. In the posttest phase, equivalence relations were derived in all the stimulus class sets 1, 3, and 4. Thus, it was concluded that stimulus equivalence was observed through the stimulus pairing procedure in sets 1, 3, and 4. In stimulus class sets 1 and 3, the equivalence relations were observed 1 week later. In stimulus class

set 4, the number of correct responses decreased at the pretest level 2 weeks later. After retraining with stimulus pairing, the number of correct responses increased and stimulus equivalence was again observed. In sets 3 and 4, he could also read most of the kanji characters.

IV. Discussion

This study showed that a boy suffering from autism could learn and derive stimulus relations through stimulus pairing training. This result will help in expanding the choice of training approach in applied settings. There was no learning in stimulus class set 2; however, this may be due to the participant's preference of the stimuli used in stimulus class sets 1, 3, and 4 than set 2. In his behavioral observation, he drew the figure of many animals and spontaneously played with animal puzzles. His preference for the stimuli in sets 1, 3, and 4 may have attracted more attention and the learning might have been further promoted. In future research, some studies will be necessary to refine this new training approach in persons with developmental disabilities. This may be in reference to, for example, whether the variables that are used to promote learning in MTS training also function as promoting variables in the stimulus pairing training procedure. Other studies that compare the effects of training between MTS training and pairing training will be also necessary.

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